Therapeutic effects of phenolic compounds in extra virgin olive oil

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ABSTRACT

Olive oil can be considered as a functional food because they carry a number of beneficial effects on the organism beyond nutritional benefits accepted. Studies conducted so far have shown that phenolic compounds in olive oil have positive effects on various physiological biomarkers, while exhibiting high bioavailability. Experimental studies (in vivo and in vitro) on phenolic compounds in olive oil have been shown to beneficially alter the lipid composition of the cell and platelet function, microbial activity and bone formation and reduce oxidative damage and inflammation. This could explain the low rate of diet-related diseases among populations living in the Mediterranean region. Finally, further studies in the research results demonstrate the beneficial effects of phenolic compounds in olive oil in relation to bone health, which would be effective as adjunctive therapy to promote bone formation at the site surgical dental implants.

Key words: Olive oil, polyphenols, antioxidants.

INTRODUCTION

Olive oil can be considered a functional food as well as, providing nutrients to meet the metabolic requirements of the individual and contains other components that exert beneficial effects on the organism beyond nutritional benefits accepted. Olive oil is comprised of fatty acids, vitamins, volatile components and water soluble. It is also rich in monounsaturated fatty acids (mainly oleic acid) and contains appropriate amounts of linoleic acid group that has potent antioxidant properties, which are esters of tyrosol and hydroxytyrosol and oleuropein including Oleocanthal and vitamin E (Stark and Madar, 2002; Cicerale et al., 2010).

OLIVE OIL CHARACTERISTICS

Virgin olive oil is produced from the first and second presses of olive fruit by cold pressing method (in which no chemicals and only a small amount of heat is applied) and is composed of a glycerol fraction (which constitute 90 to 99% of the olive) and an unsaponifiable fraction or glycerol (comprising 0.4 to 5% of olives) containing phenolic compounds (Corona et al., 2009).

Historically, the beneficial health effects of the intake of virgin olive oil were attributed to the fraction of glycerol with its high concentration of mono-unsaturated fatty acids (MUFA) (mainly oleic acid) (Tripoli et al., 2005). However, a number of seed oils (including sunflower, soybean and rapeseed), which contain high amounts of mono-unsaturated fatty acids are beneficially ineffective in altering the risk factors of chronic diseases (Aguilera et al., 2004).

The studies conducted so far (including humans, animals, in vivo and in vitro) have shown that phenolic compounds of olive oil have positive effects on various physiological biomarkers, so they are marked as partially responsible for the health benefits associated with Mediterranean diet (Singh et al., 2002; Trichopoulou et al., 2003; Hu, 2003). It has also been reported that these phenolic compounds of olive oil have a high bioavailability and reinforce their potential health-promoting properties (Covas et al., 2006).

The phenolic fraction of virgin olive oil is heterogeneous, with at least 36 different phenolic compounds structurally identified. The phenolic concentration variation between
differences in bioavailability of phenolic compounds in olive oil have a high bioavailability (Carrasco-Pancorbo et al., 2006).

Studies have shown increased hydroxytyrosol and tyrosol bioavailability when administered as a solution in olive oil compared to an aqueous solution. It was suggested that the differences in bioavailability occur due to high antioxidant content of olive oil in comparison with the water and the high content of antioxidants may have protected the decomposition of phenolic compounds in the gastrointestinal tract before absorption (Tuck et al., 2001).

The mechanism by which phenolic compounds absorb olive oil is still unclear. However, the different polarities of the various phenol compounds have been postulated to play a role in the absorption. For example, tyrosol and hydroxytyrosol are phenolic compounds and poly compounds absorption occurs through passive diffusion. Oleuropein glycoside can be absorbed through a different mechanism; it is proposed that it can diffuse through the lipid double layer of epithelial cell membrane and be absorbed by a glucose transporter (Franconi et al., 2006).

With respect to the mechanism of absorption of less polar phenolic compounds, such as oleuropein aglycone and ligstroside, no data are currently available. Further research is needed to corroborate the absorption mechanisms of these compounds and to further investigate the mechanisms of other phenolic compounds.

The metabolism of phenolic compounds in olive oil is important in determining their availability. If these compounds are converted into active metabolites they may have noticeable effects on its bioavailability. Thus, we can see that oleuropein glycoside, oleuropein aglycone and ligstroside, become hydroxytyrosol or tyrosol and are excreted in the urine. The hydroxytyrosol and tyrosol are conjugated with glucuronic acid and excreted in urine as glucuronides (Berrougui et al., 2006).

On the other hand, a low amount of phenolic compounds present in the urine after ingestion (5 to 16% of total intake) indicate that these compounds are readily absorbed. Studies show that humans absorb a significant portion (40 to 95%) of the phenolic compounds of olive oil consumed in the diet (Bianco, 2002). However, more research is required on the pharmacokinetics of these compounds.

**BENEFICIAL HEALTH EFFECTS**

Elevated levels of Total Cholesterol (TC) and Low Density Lipoprotein (LDL-C) have been established as risk factors for atherosclerosis, which is the primary cause of cardiovascular disease (CVD). Animal studies have shown that intake of virgin olive oil rich in phenol led to improvements in the blood lipid profile. A study in rabbits demonstrated a reduction in circulating TC and an increase in high density lipoprotein (HDLC) associated with the consumption of virgin olive oil. Furthermore, studies in rats have shown that intake of virgin olive oil rich in phenols reduces TC, LDL-C and triglycerides (TG) and substantially increases HDL-C (Gorinstein et al., 2002).

Human studies showed that phenolic compounds of olive oil increases HDL-C and decrease the TC, so one might infer the beneficial effect of olive oil on cardiovascular disease prevention (McGeer et al., 2009). Furthermore, it is well established that the pathophysiology of common diseases such as cancer, arthritis and neuro-degenerative diseases associated with chronic inflammation (Karlson et al., 2009; Solinas et al., 2009; Solinas et al., 2009) is also prevented.

It has been reported that the phenolic compounds derived from extra virgin olive oil may attenuate the inflammatory responses in the body and therefore reduce the risk of development of chronic inflammatory disease (Gicerale et al., 2012).

Olive oil contains a group of related natural products that are potent inflammatory and antioxidant properties. It is postulated that olive oil contains a healthy balance of omega-6 and omega-3 fatty acids, resulting in a decrease in inflammation (Weinbrenner et al., 2004).

Olive oil showed lower oxidative stress and the production of metabolites of arachidonic acid through prostaglandin synthetase G/H in rat macrophages (Beauchamp et al., 2005). Similarly, it has been demonstrated that free radicals are involved in bone resorption and osteoclast differentiation such that bone resorption is increased in oxidative stress. The increase in oxidative stress can be attributed to the loss of the antioxidant effects of estrogen in post-menopausal women (Sheweita and Khoshhal, 2007). It has been shown that supplementation with extra virgin olive oil attenuates ovariectomy-induced osteoporosis in an experimental
model with rats. A probable reason for this improvement in bone loss could be attributed to its high content of mono-unsaturated fatty acids which affect bone mineral density (BMD) (Puel et al., 2006, 2008; Saleh and Saleh, 2011).

CONCLUSIONS

In conclusion, the phenolic compounds in olive oil are highly bioavailable in humans. The high bioavailability of these compounds supports the evidence that these phenolic compounds have beneficial effects on health. Though, these beneficial effects of ingestion of virgin olive oil are well known, only recently have they investigated the biological properties of phenolic compounds in olive oil.

Experimental studies (in vivo and in vitro) on phenolic compounds in olive oil have been shown to beneficially alter the lipid composition of the cell and platelet function, microbial activity and bone formation and reduce oxidative damage and inflammation. This could explain the low rate of diet-related diseases among populations living in the Mediterranean region. Finally, further studies research results demonstrate the beneficial effects of phenolic compounds in olive oil in relation to bone health, which would be effective as adjunctive therapy to promote bone formation at the site surgical dental implants.

REFERENCES


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